Materials Engineering Branch

TIP*

No. 097 Use of Hard Anodized Aluminum for Electrical Isolation

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Plastic film materials such as Kapton or Mylar and ceramic materials such as beryllium oxide (BeO) are commonly used to provide electrical isolation between electrically conductive surfaces. A typical example is a power diode mounted to a metal substrate where the two are separated by a plastic or ceramic material to prevent electrical shorting. The plastic insulators are easily torn or distorted which can lead to electrical failure. This was observed in hardware fabricated for several flight programs that was subsequently disassembled for inspection. Hardware disassembly was the result of a failure on the Atmospheric Explorer-D spacecraft that occurred in space on hardware utilizing thin (3 mil) Kapton washers as insulators.

Also, experiences with ceramic materials for similar applications show them to fracture easily. The use of both materials for this kind of application requires that the installer use extreme care to ensure material integrity. In applications such as the above, post-assembly visual inspection will not detect damaged material and even though electrical failure may not be present immediately, it may be imminent.

A method for achieving electrical isolation and simultaneously ensuring material integrity is with the use of a hard-anodized aluminum washer instead of the plastic or ceramic material. (Hard anodizing should be per MIL-A-8625C, Type III, or equivalent.) This technique has been successfully used on the MMS Project.

As the breakdown voltage of anodic coatings is dependent on the thickness of the anodize, the user must, as a minimum, electrically test the hard anodized aluminum washer to make sure it meets the electrical requirements. For example, the DC breakdown voltage $\simeq$ 500 volts for a 1 mil (0.001 inch) thick anodize coating, whereas, the breakdown voltage $\simeq$ 2500 volts for a 5 mil (0.005 inch) thick coating. The anodized (non-conductive) metal washer can be used in conjunction with a plastic washer if the user desires an extra margin of confidence.

The reader could explore this technique for use in other applications; e.g., in photo multiplier tube power supply configurations where the aluminum housing could be hard anodized to prevent possible corona discharge from the electronic components to the housing.

NOTE: Be sure not to scratch the anodize as this could result in electrical shorting.